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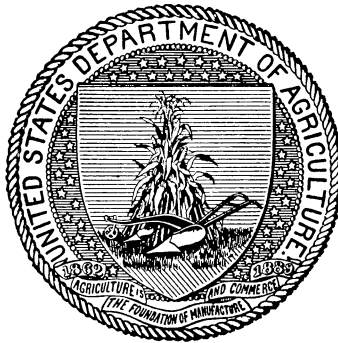
FARMERS' BULLETIN 380.

THE LOCO-WEED DISEASE.

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., October 2, 1909.

SIR: We have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin a manuscript entitled "The Loco-Weed Disease," by Dr. C. Dwight Marsh, Expert in Poisonous-Plant Investigations, Bureau of Plant Industry.

A detailed account of the laboratory investigations of Dr. Albert C. Crawford upon the cause of "loco" poisoning has been issued as Bulletin No. 129 of the Bureau of Plant Industry. A technical companion bulletin upon the field investigations of "loco" by Doctor Marsh has been issued by the Bureau of Animal Industry as Bulletin No. 112, to which readers interested in an extended account of the experiment and wishing to see illustrations of the "loco" plants and of animals affected with the disease are referred.

The manuscript herewith, prepared in response to the great demand for immediate information upon the outcome of these investigations, is a brief practical presentation of the results of the work upon the "loco" disease and is intended to meet the immediate needs of ranchmen and stockmen on the western ranges and the National Forests.

Respectfully,

B. T. GALLOWAY,
Chief, Bureau of Plant Industry.
A. D. MELVIN,
Chief, Bureau of Animal Industry.

HON. JAMES WILSON,
Secretary of Agriculture.

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THE LOCO-WEED DISEASE.

INTRODUCTION.

The word "loco" is of Spanish origin, meaning crazy, and has been popularly applied for a long term of years to a disease common among horses, cattle, and sheep in the Great Plains region of the West. The first printed record of this disease seems to have been in the Report of the Commissioner of Agriculture for 1873, and the descriptions of the symptoms of locoed animals in this and the succeeding reports of the United States Department of Agriculture are among the best written.

The losses of horses, especially in parts of Texas, have at times been very large, while in some localities in Colorado, Nebraska, and Kansas it has been found impossible to run horses freely upon the range because of the large number that die from this disease. The losses of cattle have been heavier, perhaps, in Colorado than in any other State, while the losses from locoed sheep have occurred more frequently in the States farther north, especially in Montana.

A large amount of investigation, both in the field and in the laboratory, has been undertaken, but the results were very contradictory. Many people were convinced that while there was a diseased condition among the stock which doubtless caused very heavy losses, this was due to food or other causes rather than to any specific poisonous effect produced by eating plants. The majority of stockmen, however, were convinced that the disease was caused by eating certain plants, which on this account were known to them as "loco plants."

LOCO PLANTS.

A large number of plants have been called by the name "loco weeds," most of those which were suspected of being poisonous belonging to the botanical family Leguminosæ, to which belong also the pea, alfalfa, and other similar plants. In western Texas, western Nebraska, western Kansas, and in portions of eastern Colorado the term "loco weed" was applied specifically to the plant known to botanists as *Astragalus mollissimus*.

THE PURPLE LOCO WEED.

Astragalus mollissimus, popularly known as the "purple loco" or the "woolly loco," sometimes as the "Texas loco" or the "true loco" (fig. 1), is the plant that in the past has been considered as the more probable cause of loco poisoning. This is sometimes known as the "stemmed loco plant," because it has true stems, while the white loco weed (*Aragallus lamberti*) is stemless. The former is a perennial plant growing in patches on adobe soil, in depressions rather than in elevated situations. It rarely grows in the abundance which is characteristic of some of the other so-called "loco plants," but it may



FIG. 1.—A plant of the purple loco weed (*Astragalus mollissimus*).

cover several acres. Under favorable circumstances where a plant grows for several years it may become, perhaps, a foot in height and possibly 2 feet in diameter. The flowers are a very deep purple and the pods short, black, and thick. The leaflets are ovate or elliptical and very densely covered with hairs, from which the plant gets its common name of "woolly loco." The plant has a decumbent habit; that is, the long branches are inclined to lie rather close to the ground.

The purple loco plant is found as far north as South Dakota, as far south as Mexico, and as far west as parts of Arizona. Its eastern limit may be stated as central Kansas and Nebraska and the western

part of Oklahoma. (See fig. 2.) In these regions it grows in varying abundance. It blossoms in Colorado about June 1, but farther south—in New Mexico, for instance—blossoms are found early in April.

THE WHITE LOCO WEED.

The white loco plant (*Aragallus lamberti*) (fig. 3) is distinguished from the purple loco by its long lanceolate leaves and by the general habit of the plant, which is erect rather than decumbent. It has no true stem, and on this account is sometimes called the "stemless loco." The flowers are ordinarily on long flower stems and commonly are white in the Plains regions, although there is considerable variation in their color. Purple flowers are not uncommon. In the mountain regions the white loco ordinarily has very deeply colored flowers—

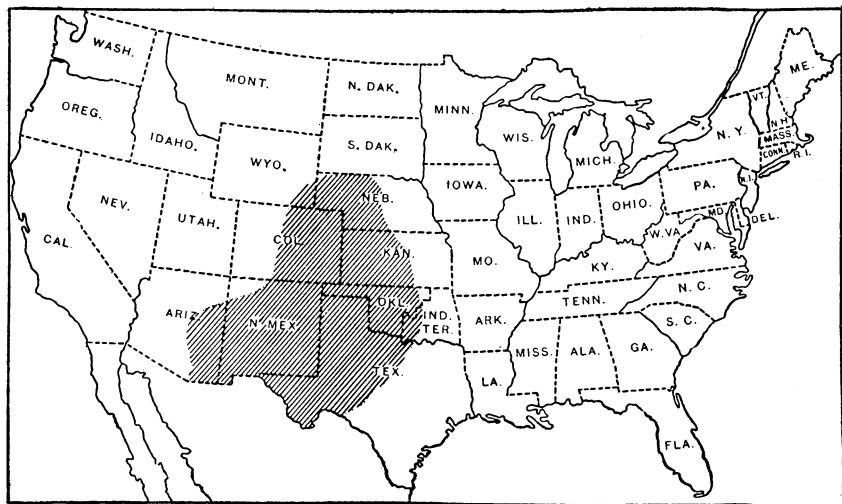


FIG. 2.—Map of the United States, showing the distribution of the purple loco weed.

deep shades of violet and purple. It blossoms earlier than the purple loco. Plants blossom in Colorado in the latter part of April, and early in the summer the flowers disappear and the pods are found upon the still erect flower stems. The pods of *Aragallus lamberti* are slender and filled with seeds, which, when the pods dry, rattle as a person passes through a patch of the plants, making a sound which closely resembles the warning of a rattlesnake. In this plant, as in the purple loco, there is an extremely long root, growing down from 3 to 6 feet.

The white loco is found much more widely distributed than the purple loco, extending from the northern to the southern border of the United States, as far east as central Minnesota, and as far west as

western Utah and Arizona. (See fig. 4.) It grows largely on elevations and on sandy soil, and in some places in very great abundance. In parts of Colorado at the time of blossoming large areas are as white as though covered with snow, and in the more elevated regions of Montana, Colorado, and Arizona the patches of beautiful dark-colored flowers are very striking.

Aragallus lamberti goes under the common names of "white loco" and "rattleweed." The term "white loco" in the mountains is,

however, sometimes popularly applied to another leguminous plant. From the color of the flowers in the mountains it is also sometimes known as the "pink loco."

OTHER LOCO WEEDS.

The experimental work in the field and in the pharmacological laboratory of the Bureau of Plant Industry has been largely upon the two species known as the purple loco and the white loco. These are the weeds which produce the disease from Montana to northern New Mexico and Arizona,

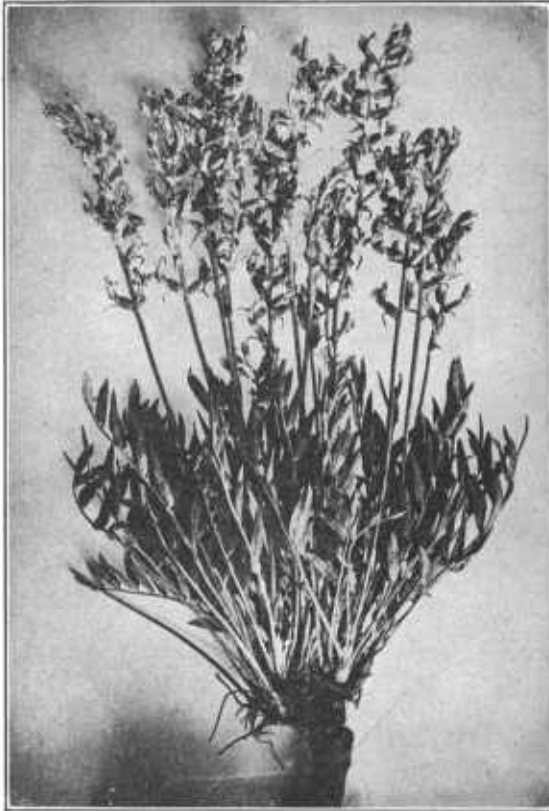


FIG. 3.—A plant of the white loco weed (*Aragallus lamberti*) in flower.

and in western Texas. In parts of New Mexico, Arizona, and California there are found great numbers of locoed animals in localities where neither of these two species grows. Other leguminous plants in these places are known as loco weeds, and while the field investigations and laboratory tests of these plants have been very incomplete it has been proved that some of them are poisonous and the symptoms of locoed animals and the pathological findings are similar to those produced by the Colorado plants. They, like the two species which have been more

thoroughly examined, contain barium, which Doctor Crawford thinks may be connected with the poisonous effects of the plants.

Four different species, known as *Astragalus diphysus*, *Astragalus arizonicus*, *Astragalus thurberi*, and *Astragalus bigelovii*, have been examined in a preliminary way. They, like the species of *Astragalus*

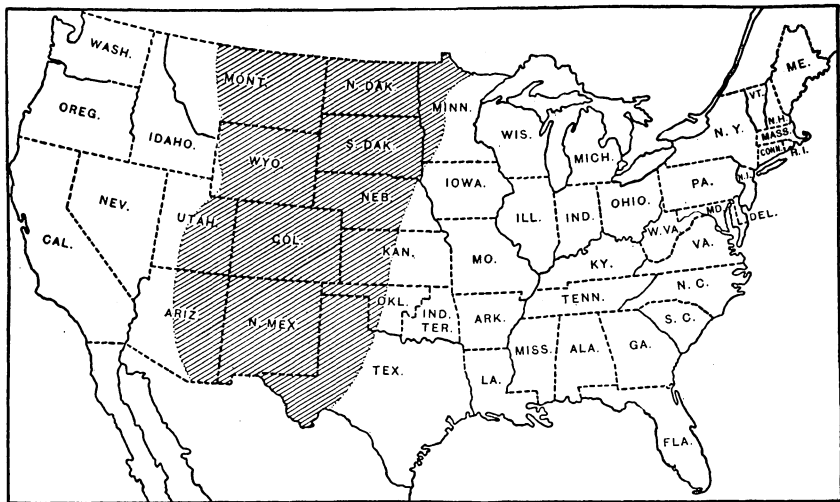


FIG. 4.—Map of the United States, showing the distribution of the white loco weed.

of California, are popularly known as “rattleweeds,” but it should be noted that these are quite different from the rattleweed of Colorado. Investigations of some of these other plants are now being carried on by the Bureau of Plant Industry, and it seems probable that a considerable number of leguminous plants are poisonous and can properly be known as loco weeds.

POISONING BY LOCO PLANTS.

It was found when the loco investigation was undertaken by the Bureau of Plant Industry that there was a very general belief among stockmen that the purple loco weed was a poisonous plant and a less general belief that the white loco weed was injurious.

The field work which has been carried on during the past three years has demonstrated that horses, cattle, and sheep in the field can be poisoned by feeding upon these two plants. It has also been shown very clearly that the purple loco weed is very rarely injurious to cattle. In those sections where the purple plant is the only loco weed known, the losses from poisoned stock are found to consist almost exclusively of horses. This seems to be because cattle will not readily eat this plant. The experiments show that under ordinary circumstances most cattle would prefer to starve rather than to eat any of the purple loco

weed. The majority of horses do not take readily to this plant except as they are induced in the first place to eat some of it because of short feed. It has been demonstrated that the so-called loco disease of the Plains is not simply a matter of starvation, as has been supposed by many, and it is also clear that when other food is abundant very few horses will eat loco. When, however, because of shortness of grass a horse is induced to begin the eating of loco, it is very likely to contract a habit which leads to continual feeding upon the weed, with eventually fatal results.

In regard to the white loco weed the experiments showed very clearly that horses, cattle, and sheep will eat this plant with great readiness, particularly if they come across it at a time when grass is somewhat scarce. Both the white and the purple loco weeds are green during the winter, when all grass on the plains is dry and brown. They are prominent plants, too, which induces an animal to try them, and because of their succulent character and somewhat pleasant taste, it may continue to eat them. Not only horses but cattle and sheep will eat the white loco weed, and sometimes even with great avidity. Many animals will eat this weed even when grass is abundant, but it is more common for the habit to be contracted during the autumn, winter, and spring, when there is a scarcity of green grass. Both horses and cattle will eat the white loco weed readily, but perhaps cattle take to it more readily than horses. During the spring months, before the grass starts, where the white loco weed is abundant practically all animals eat more or less of it. As the grass becomes more abundant many of these leave the loco weeds and devote themselves entirely to grass. These animals as a rule do not seem to be injured by the habit. Others, however, acquire a taste for the plant and an appetite which is not easily overcome, and will continue to eat the loco weed even where there is an abundance of other feed. Whether an animal will become locoed or not is then simply a matter dependent upon the individual. Some cattle and horses will eat loco weeds during a part of the year for a period of years and suffer no harm. Others acquire a habit which leads them to eat this plant almost exclusively, and these will die within a few months or, in some cases, even within a few weeks.

Sheep, also, are poisoned in much the same way as horses and cattle. The effect of the poisoning seems to be peculiarly noticeable on lambs. Frequently lambs will die within two weeks of the time when they commence to eat this weed, and without any marked loss of flesh.

It should be said, perhaps, in this connection that there is considerable difference in the readiness with which various breeds of animals will eat loco weeds. It is a matter of common observation upon the

Plains that the so-called "native breeds" are very much less likely to be locoed than are imported animals. This, of course, is as one would expect, from the fact that the imported animals are not familiar with the plants and in many cases do not have the quality of "rustling," so that they are inclined to eat the food which is most easily obtainable rather than seek more suitable plants. Generally speaking, the finer breeds of cattle and horses are more likely to be locoed than the poorer breeds. The same thing is true of sheep, it being particularly noticeable that the black-faces are much more apt to be locoed than are the Merinos.

SYMPTOMS OF POISONING IN HORSES.

The first symptom of loco poisoning in horses is often a change in the general condition of the animal. If high-lived the animal becomes somewhat dull. Following this, irregularities in its gait and in its mode of eating appear. The irregularities in the gait may be due partly to weakness and simulate a paralytic affection. The horse drags its feet more or less, this being particularly noticeable in the hind legs. Associated with this paralytic condition is an apparent loss of muscular coordination. In stepping over a slight obstruction the horse lifts its feet unnecessarily high, or in going over a rut in a road it may leap as if jumping over a ditch. As the disease progresses the animal becomes solitary in its habit and seems to lose very largely its nervous sensibility. If one approaches a badly locoed horse the horse does not notice the person until he is within a few feet, when it may suddenly rear and perhaps fall over backward. When it drinks or when it eats there is a peculiar stiff motion of the jaws, showing a lack of control of the muscles. If a locoed horse is used either in riding or driving, this lack of muscular coordination may make it extremely dangerous, as such a horse shies violently at imaginary objects, can not readily be led or backed, and if started in motion is inclined to go in an automatic fashion at the same gait until stopped by some obstruction. In the later stages of the disease the animal loses flesh, its coat becomes rough, and eventually it ceases to eat and dies.

SYMPTOMS OF POISONING IN CATTLE.

The symptoms of locoed cattle are very similar to those of locoed horses, the differences being only such as would be expected from the different character of the nervous organization of the animals. There is the same lack of muscular coordination, and while a steer is not apt to fall over backward, it will start and tremble and perhaps rear and jump backward when suddenly alarmed. A badly locoed steer shows a violently shaking head, particularly after it has become heated.

Ordinarily a locoed steer is dull, but under some conditions it may become frantic and will run into obstructions in an utterly unreasonable way. It is commonly said by stockmen that it is impossible to drive a locoed steer, because it is just as likely to run into the driver as in the opposite direction.

Locoed cattle gradually lose flesh, have staring eyes and rough coats, go to water less and less frequently, and eventually die of starvation.

SYMPTOMS OF POISONING IN SHEEP.

The symptoms of poisoning in sheep are not so marked as those in horses and cattle. The lack of muscular coordination is not so noticeable, but still exists. Locoed sheep show, perhaps, more clearly the weakness which goes with the disease, as they stumble and fall, and rise again only with great difficulty. The symptoms of loco poisoning in sheep resemble the symptoms caused by "grub in the head," or *Oestrus ovis*, and it is at times difficult to distinguish between sheep affected by this grub and those that are poisoned by loco weeds.

POST-MORTEM APPEARANCES.

The post-mortem examinations of locoed animals do not in all cases show clearly marked evidence of the progress of the disease. Since in all cases of fatal poisoning the locoed animals die of starvation they are profoundly anemic, as would be expected, and, as a result of this anemia, accumulations of coagulated serum in a gelatinous form are found in various parts of the body. These accumulations are particularly prominent about the heart. There is also an accumulation of coagulated serum in the cavity of the spinal column. This is almost always present in cases where the loco poisoning has become a chronic condition. The nervous system is more fully supplied with blood than is the case with an animal in normal condition. This, however, is not a very pronounced feature, and the blood clots which are occasionally found in the brain are not so evident as would be expected from the accounts published in the literature upon loco poisoning.

The poisonous substance in the loco plants produces an irritant effect upon the stomach and intestines, and in the larger number of locoed animals this results in an inflamed condition of the walls of the stomach. It is common to find ulcers in the pyloric end of the stomach of horses, and similar ulcers in the fourth stomach of cattle and sheep.

RESULTS OF LABORATORY INVESTIGATIONS.

The laboratory tests of the purple and the white loco weeds made by Dr. A. C. Crawford, Pharmacologist in the Office of Poisonous-Plant Investigations, have shown that both of these species possess

poisonous properties, and he considers these properties due in part to the presence of barium. Doctor Crawford has shown very clearly, too, that the purple loco is more poisonous than the white weed.

TREATMENT OF LOCOED ANIMALS.

Experiments with substances which would be logical antidotes for loco poisoning have been disappointing, and at the present stage of the investigation there seems to be no reason for hoping that a practical antidote can be found. During the course of the experimental work which was carried on in Hugo, Colo., however, attempts were made to treat the animals in accordance with the more pronounced symptoms, and this treatment was so successful that it can be said that it is possible to bring most animals out of the locoed condition and restore a large part of their value, provided the animals are worth enough to warrant a somewhat extended course of treatment.

The first, and without any doubt the most important, part of the treatment is the food. As a matter of fact many locoed animals, especially in the earlier stages of the disease, can be cured by simply taking them away from the loco weeds and feeding them upon nutritious food like alfalfa and grain. All chronically locoed animals are constipated, and the food should be of such a character as to remove this condition. For this purpose alfalfa and oil meal have been used, although any other food having laxative properties would be useful. Probably nothing is better for locoed horses and cattle than to turn them, under proper precautions, into a field of alfalfa.

Where the constipation is of an obstinate character it has been found desirable to give doses of Epsom salts. The dose used in experiments with mature cattle was about 1 pound, given in the form of a drench. For younger animals the dose was smaller, calves receiving not more than 2 ounces. For horses the dose should be about 8 ounces, and for full-grown sheep 4 ounces. These doses varied with the size and condition of the animal, but commonly rather small doses were found sufficiently effective. It was not necessary to repeat the treatment many times, provided care was taken to give food of a laxative character.

A large number of experiments were made to determine what remedy would be best to improve the nervous condition of horses and cattle, and the results seemed to show that for horses nothing was better than arsenic in the form of Fowler's solution, while for cattle the best success was obtained by the use of strychnine. The Fowler's solution was given in daily doses of 4 to 6 drams, or 15 to 20 cubic centimeters, in the grain or in the drinking water of the horses. These doses should be continued for a considerable period, the time

varying with the individual animal, but ordinarily for not less than one month.

The strychnine was given in hypodermic doses, the cattle being run through a chute and treated one after another. Locoed animals are very sensitive to strychnine, and it was found necessary to give it in extremely small doses. The daily doses should not ordinarily exceed three-twentieths or four-twentieths of a grain, or 0.009 to 0.012 of a gram. Large animals may take as much as one-half grain, but this is a maximum dose and often will be found too much. This treatment should be continued, as in the case of Fowler's solution, for a considerable time, ordinarily thirty days or more. The fact should be emphasized that the doses of strychnine should be very small. It was found that animals could very readily be killed with what are considered the common veterinary doses, but in small quantities the results were distinctly beneficial.

It was also found that sodium cacodylate when given to cattle in hypodermic injections of 6 grains, or 0.4 gram, daily commonly gave beneficial results. The best results, however, were obtained from the use of strychnine and Fowler's solution as already outlined. Cattle in very bad shape were taken and after treatment were turned out in suitable condition to be sold for fat beef, while horses which were absolutely worthless recovered and became entirely usable, although probably they were not in as good condition as they would have been if they had not been poisoned. The experiments show conclusively that if horses or steers are considered valuable enough to be treated in this way the majority can be brought into good condition.

The fact should be emphasized that very rapid recoveries can hardly be expected. The condition existing in a case of chronic loco poisoning has been brought about gradually by weeks or months of loco feeding, and the rate of recovery must necessarily be rather slow.

Very much can be accomplished in the way of preventing loco poisoning by the proper handling of stock. It has already been stated that it is in times of short feed that the stock commonly contract the habit of loco feeding. Feeding hay during this period will prevent many animals from acquiring the habit. On some ranges the loco weeds have a rather definitely limited distribution; in such cases, if kept away from the infested areas until the grass is started, few of the stock become locoed.

DESTRUCTION OF LOCO WEEDS.

There is a common belief among the stockmen of the infested regions that in order to destroy the loco plants it is necessary to dig up the whole root, so that it has seemed to them almost impossible to clear a field infested with loco, even though the field is of compara-

tively limited extent. This impression in regard to the necessity of digging the whole root is false. If either the purple or the white loco weed is cut off below the crown of buds the plant is killed. There is no danger of sprouts from the roots. The seeds of these loco plants live for a term of years and do not all germinate the season following their growth. Consequently, in any field infested with loco there will be a continuous crop of plants, as these seeds under favorable circumstances germinate.

The impression that plants grow from the cut roots probably originated in the fact that seedlings are continually coming up in the immediate vicinity of a parent plant. The seeds of the purple and of the white loco weeds are not provided with any special means of dispersal by the winds. Ordinarily they fall near the parent plant and grow in that locality. Of course the winds which move the dust of the surface will carry the seeds from one place to another, but under ordinary circumstances they are not dispersed for any considerable distance.

It follows that to cut out the loco weeds in pastures is a comparatively easy matter. A man with a spade can destroy the plants with great rapidity. A few days' work will accomplish much more than one would expect. Because of the seeds which germinate later, it is necessary for this work to be done two or three times during a season, and it is also necessary that it be repeated during succeeding seasons. It has been demonstrated at Hugo, Colo., that this is not a very laborious piece of work. The loco-free pasture which was used for experimental purposes was cleared the first year of the experiment by a few days' work, and with very little labor has been kept entirely free from loco since that time. The fact that the wind does not readily carry the seeds from one place to another prevents reseeding from other pieces of ground containing loco weeds, even when in the immediate vicinity. Where pastures are fenced it is comparatively easy, and certainly profitable, to dig out the loco plants. This is particularly easy in the case of the purple loco weed, for it rarely grows in any large quantity. The possibility of clearing pastures of loco weeds has been demonstrated by many ranchmen, as well as by the station at Hugo.

Certain insects work upon the roots of the loco plants and in some cases occasion quite extensive destruction. At the present time in Colorado, western Kansas, and Nebraska the purple loco weed is destroyed to a very large extent by the larva of a moth known to entomologists as *Walshia amorphella*, and there is reason to believe that the work accomplished by the larvæ will reduce the quantity of the purple loco weed in this region to such an extent that for a few years loco poisoning from these plants will be very slight. Doubtless after several years the work of the insect will lose its efficiency and the plant will have another cycle of renewed activity. There are also

insects working upon the white loco weed, especially the grubs of a weevil (*Cleonus quadridlineatus*), but so far they have not produced such destructive effects as have been noticed in the case of the purple loco. During exceptionally dry seasons very few of the loco plants germinate, and if, at the same time, the insects are abundant, as was the case during the summer of 1908, the numbers of loco plants become greatly reduced.^a

SUMMARY.

(1) The purple loco and the white loco weeds produce the loco disease. The former is the most poisonous, but it affects horses almost exclusively, because other animals do not eat it. The latter is eaten by cattle and sheep, as well as by horses, and produces the disease in all of these animals.

(2) Barium is found in many loco plants, and its connection with the poisonous effects is still under investigation.

(3) Other leguminous plants in Arizona, New Mexico, and California, locally known as "rattleweeds," produce the same symptoms as the purple and the white loco weeds and are supposed to contain the same poisonous substance.

(4) Locoed animals may recover under careful feeding, but the cure is hastened by the use of Fowler's solution for horses and strychnine for cattle.

(5) The purple and the white loco weeds may be eliminated from fenced pastures, and provided the crown of buds is cut off they will not grow from the roots.

(6) In some localities much can be accomplished in the way of preventing loco poisoning by feeding horses, cattle, and sheep during periods of short feed and by keeping the stock away from infested areas.

^a Both of these species are treated more in detail in Bulletin 64, Bureau of Entomology, U. S. Dept. of Agriculture, pp. 33-42, which includes a list of all insects known to subsist on loco weeds.